Automated Parsivel Unit (APU) data processing during Wallops Flight Facility operation.

The database presented in this document was used in Tokay et al. (2016) study DOI: 10.1175/JHM-D-15-0159. Table 1 of the manuscript coordinates and the distance between the instruments. The coordinates of the APU sites are given as:

37.944˚N, 75.463˚W APU11
37.934˚N, 75.471˚W APU12
37.937˚N, 75.466˚W APU15
37.929˚N, 75.473˚W APU16
37.944˚N, 75.481˚W APU17
37.937˚N, 75.456˚W APU18

The APU data has been collected at 10 seconds intervals. The raw output is the 32 x 32 diameter versus velocity matrix. In addition to the raw output at 10-second intervals, the following files are considered as input files for the data processing.

Input files:

1.1 parsivel_diameter.txt,

The files have four columns: The drop shape corrected mid bin size diameters in mm, corresponding bin width in mm, corresponding terminal fall speed in m/sec following Beard (1976, Journal of Atmospheric Sciences, volume 33, 851-864), and corrected mid bin fall velocities in m/sec. It should be noted that terminal fall velocities above 6.0 mm in diameter (bin 22 through bin 32) are subject to the error since Beard (1976) do not extend to for the drops larger than 6.0 mm. A linear interpretation has been performed for the drops larger than 6.0 mm in diameter.

1.2 parsivel_matrix.txt,

The file is a 32 x 32 matrix that corresponds to the drop size and fall velocities of the manufacturer output. The file screens the drops following ±50% terminal fall speed limit. If the drop fall is outside the ±50% of its terminal fall speed, it is regarded as secondary drop and eliminated from the processing. The matrix consists of "1" for accepted and "0" for rejected drops. This matrix is used for rain only. A fall velocity based threshold matrix is used for snow.

As part of the data processing, the 10-second observations are integrated to 1-minute. However, the time stamp of the 10-second observations has been documented in a file to distinguish the non-rainy periods from non-data collection periods. It should be noted that the thresholds of 10 drops and 0.01 mm h^{-1} has been applied to 1-minute observations to eliminate noise from rainy minutes.

Output files:

2.1 apuXX_data.wal,

XX: APU unit number 11, 12, 15, 16, 17, and 18.

The file provides the existing database. It consists of 5 to 10 columns: year, day of the year, hour, minute, and seconds (6 column maximum from 0 to 50).

2.2 apuXX_dropcounts_min.wal

The file provides the total number drops at each bin size at 1-minute integration. The file consists of 36 columns: year, day of the year, hour, minute, and 32 size bin drop counts.

2.3 apuXX_rainparameter_min.wal

The file is designed to present the integral rain parameters based on *measured* fall velocities at 1-minute integration. The file consists of 12 columns: year, day of the year, hour, minute, total number of drops, total concentration (drops m^{-3} of air), liquid water content (g m^{-3}), rain rate (mm h^{-1}), reflectivity in Rayleigh regime (dBZ), mass-weighted drop diameter (mm), standard deviation of the mass-weighted drop diameter, and maximum drop diameter (mm). It should be noted that four of these rain parameters, total concentration, liquid water content, reflectivity in Rayleigh regime, and mass-weighted drop diameter requires fall speed information in their formulations. More information on the disdrometer-based calculation of integral rain parameters can be found in Tokay et al. (2001, Journal of Applied Meteorology, 40, 2083-2097).

2.4 apuXX_rainparameter_min_ter.wal

The file provides the integral rain parameters based on *terminal* fall velocities at 1-minute integration. The file consists of 12 columns: year, day of the year, hour, minute, total number of drops, total concentration (drops m^{-3} of air), liquid water content (g m^{-3}), rain rate (mm h^{-1}), reflectivity in Rayleigh regime (dBZ), mass-weighted drop diameter (mm), standard deviation of the mass-weighted drop diameter, and maximum drop diameter (mm).

2.5 apuXX_raindsd_min.wal

The file provides the raindrop size distribution based on *measured* fall velocities at 1-minute integration. The file consists of 36 columns: year, day of the day, hour, minute, and 32-bin rain drop size distribution (drops m^{-3} mm^{-1}).

2.6 apuXX_raindsd_min_ter.wal

The file provides the raindrop size distribution based on *terminal* fall velocities at 1-minute integration. The file consists of 36 columns: year, day of the day, hour, minute, and 32-bin rain drop size distribution (drops m^{-3} mm^{-1}).

2.7 apuXX_rainevent.wal

The file provides the rain event summaries. The events are separated by 1-hour or more rain-free periods in rain rate time series that can be extracted from 2.3 or 2.4. The events that are less than 3 minute or rain total less than 0.1 mm are not included. The file has 9 columns: year, event start day of the year, event start hour and minute, event end day of the year, event end hour and minute, event rainy minutes, event maximum rain rate (mm h^{-1}), event rain total (mm), event maximum drop diameter (mm), and precipitation type (R - rain, S - snow).